Swedish Non-Lethal Weapons Research Activities

presented by
Curt Larsson, Director of Research
and
Bengt Wigbrant, Senior Research Officer
National Defence Research Establishment in Sweden.

The Swedish Defense Research Establishment (**FOA**) is purely governmental with about 1100 research officers employed of which a third are doctors. The research work is done in different areas i.e. NBC up in the north, weapon and ammo development in the vicinity of Stockholm and IT and EW in Linkoping in the south of Sweden.

Also the NLW-program is run from Linkoping. Mr Larssson and mr Wigbrant are occupied with that program.

Although Sweden has a long history of participating in peace-keeping contributions it took until a few years ago before it was decided that **FOA** should be of assistance in order to make the work easier for the observers and forces who were acting internationally. The program "Technic for International Contributions" was launched with Larsson and Wigbrant as managers.

The first thing that we did was to travel to a lot of places where Sweden was represented in peace-keeping. In every place we made ourselves familiar with the circumstances and spent many hours asking people what were the difficulties and risks in their job.

Very soon we found certain difficulties in common for all contingents: first of all landmines and snipers (especially in former Yugoslavia). These particular items were already taken care of by other research officers but we found many other obstacles that nobody at home had payed any attention to. Most of these obstacles could in fact be taken care of under the "umbrella" NLW. We decided to start with tryung to find solutions of three different impediments *all related to real situations described by peace-keeping personnel.*

Situation 1.

Actually this turned out to be an occasion where we were present by the happening.
We were visiting a chek-point manned by scandinavian UN-soldiers. Standing there we witnessed how a military convoy took no consideration to UN prohibition to pass the check-point. Instead the military commander used a bulldozer to destroy a barrier and move two APCs in order to clean the road, after which the convoy passed saluting the UN soldiers.
This situation has occurred many times in different places and is of course not good for the image of UN!
Anyway - here is a situation where the use of firearms could escalate a conflict. We had to try other means to stop the vehicles, preferrably using NLW.

One way to force a vehicle to stop is to disturbe or destroy the electronics that controlle the engine.Since we at FOA have a project on HPM (High Power Microwaves) we first thought of using this technique. Our experts told us that it would be possible in the next 5 years and that we then could stop a vehicle at a distance of some kilometers. But the equipment was needed now and the main thing is the very short distance of just 10 to 15 meters to the vehicle that you want to stop After some calculations we found that the power of an ordinary radartransmitter might be enough. Shown in figur 1 is an exemple of the powerdensity from two radartransmitters as a function of distance.

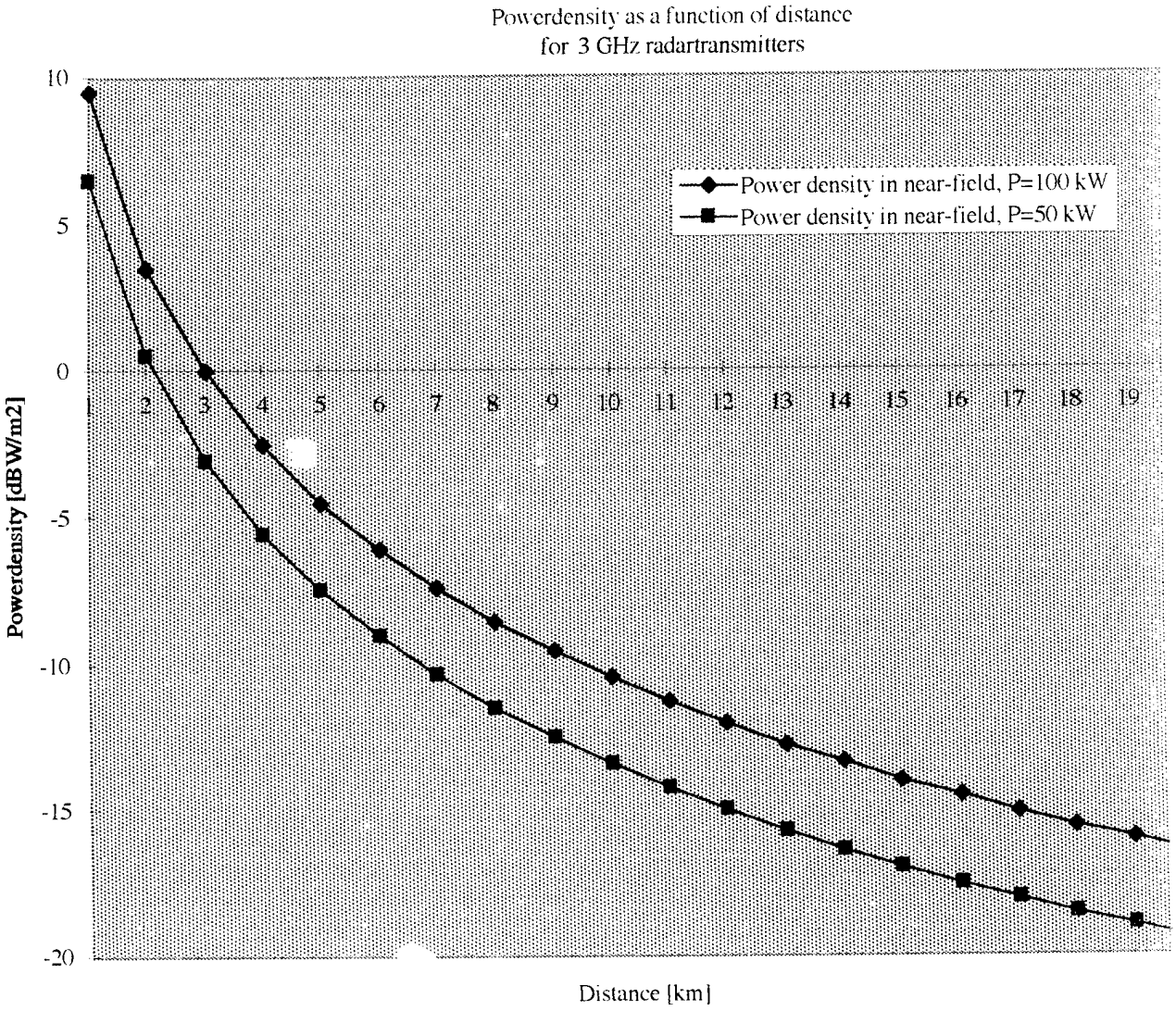

Figure 1

As seen above at normal radardistances the powerdensity is much too low to have any influence on a vehicle. But if we look at the nearfield just some meters from the antenna, see figure 2, we have a powerdensity well above the level where we can expect disturbances or even damage on engine electronics. Consequently it is possible in theory to stop a vehicle using a radar but we needed to prove it in practice.

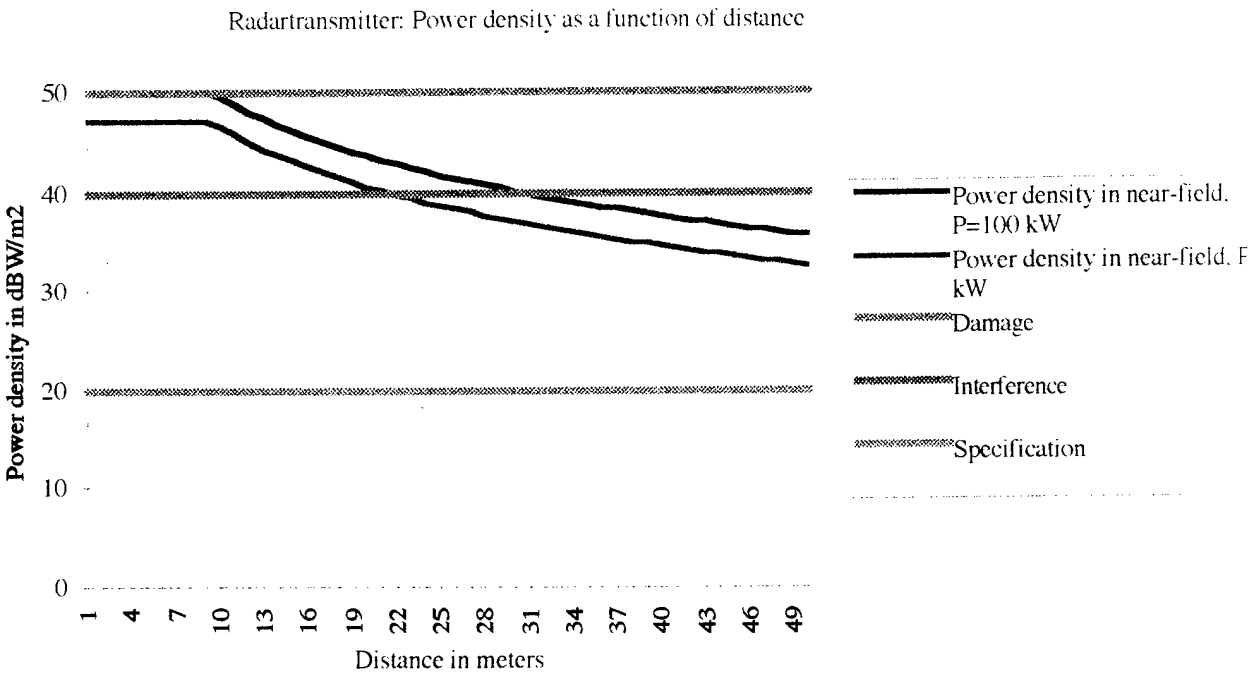

Figure 2.

The experiment was carried out in December 1995. We used a system called The Microwave Test Facility (MTF) that is capable of generating a number of radarfrequency bands at high power, see table 1.

Frequencyband	Fieldstrength V/m, max
L (1-2 GHz)	31000
S (2-4 GHz)	34000
C (4-8 GHz)	17000
X (8-12 GHz)	11000
Ku (12-18 GHz)	6100

Table 1. Given fieldstrength at 15 m distance.

The test vehicle was placed 15 meters from the transmitter antenna. Irradiation was done from two directions, see figure 3.

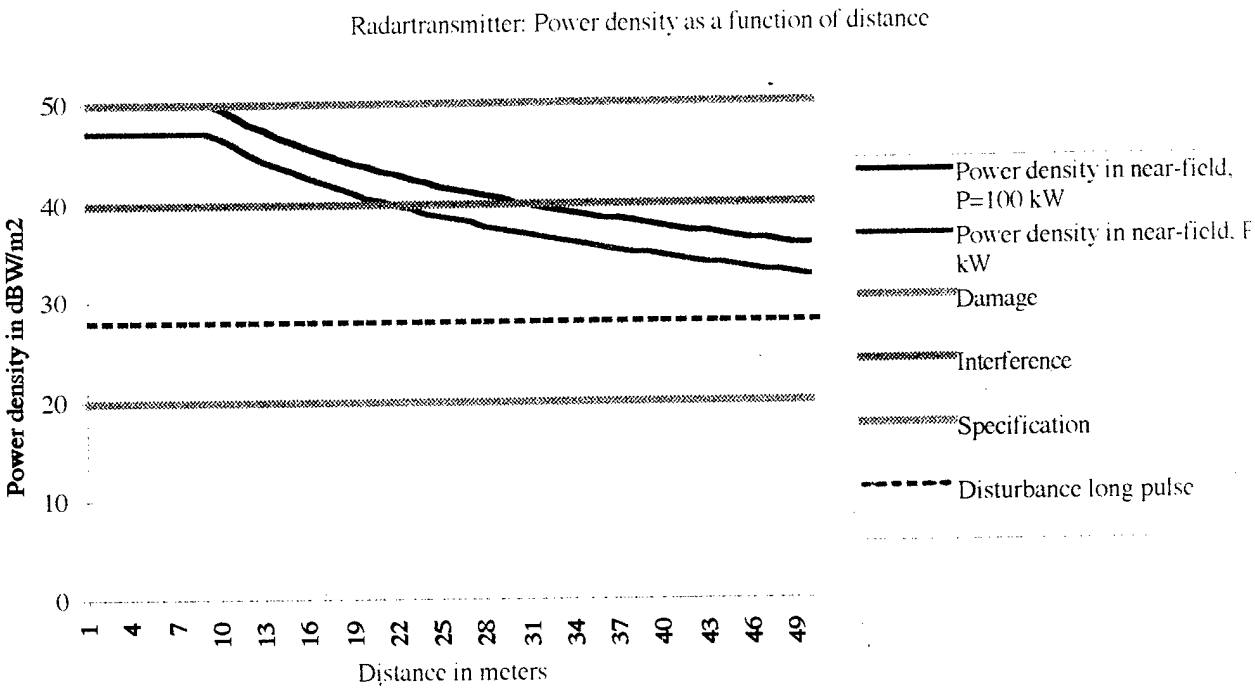

Figure 4.

Situation 2.

During the "UN-time" the swedish battalion in Bosnia had great difficulties to solve their task to escort certain transports from one village to another. What happened was that old people and children sat very passive on the road thereby blocking the UN convoy sometimes more than 70 hours. We had to find a solution where the demonstrators could be dispersed without any casualities. The solution seemed to be using acoustics.

Acoustic signals can be divided into three main types depending on the frequency response of the human ear:

- Ultra sound > 20000 Hz
- Audible sound 16 - 20000 Hz
- Infra sound < 16 Hz

We shall now give a short description of these three sound types and their potentials as non-lethal weapons.

Ultra sound

Ultra sound has the advantage of being easy to direct - it could be sent out as an acoustic bullet. However the signal is quickly absorbed in air and looses its energy after just a few meters. This means that a person exposed to an ultra sound bullet at close range first would feel just a tickling but as the sound source gets just a few inches closer the acoustic field increases rapidly and there is a great risk of getting a lasting burn on the skin. For this reason we don't think that ultra sound is suitable as a non-lethal weapon. In the table below the main features of ultra sound as a NLW are given.

+ easy to direct